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Establishment of Lodgepole Pine Reproduction after Different Slash Disposal Treatments

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Prompt restocking with natural reproduction following clear cutting is one of the fundamental objectives of lodgepole pine (*Pinus contorta* Dougl.) management in the central Rocky Mountains. Because lodgepole pine here bears a high proportion of serotinous cones, most seed for regenerating clearcuts comes from cones left in the slash. How slash is treated largely determines the adequacy of reproduction.

How different slash disposal methods after clearcutting affect establishment of reproduction and reduce fire hazard was studied from 1958 through 1963 on the Medicine Bow National Forest in Wyoming. The effect of treatments on reproduction is reported here.

The Study

The study area was a single block, 12 chains long and 6 chains wide, where the mature overstory of lodgepole pine was cut in 1958. All trees left after logging were either felled or pushed over. Four plots of 1 acre each were treated; a fifth plot of about 3 acres was left untreated (fig. 1). Slash treatments applied in the fall of 1958 were:

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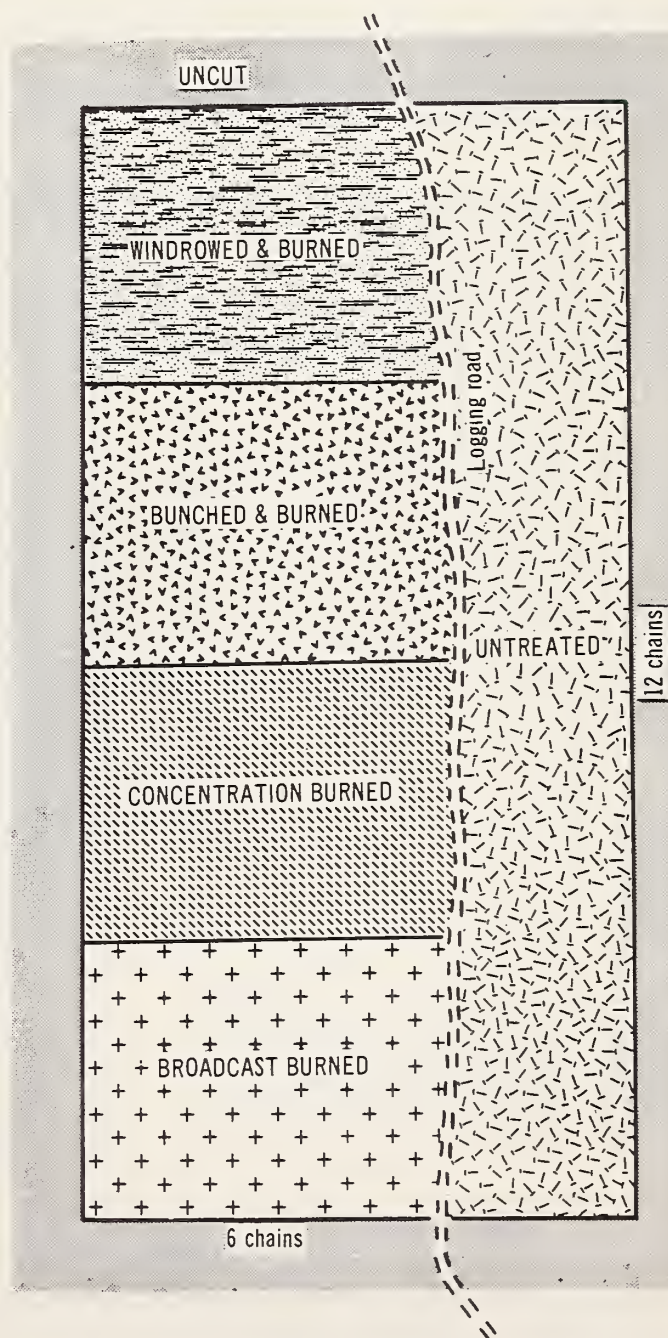


Figure 1.--Diagrammatic sketch of study plots.

1. Tractor windrowed and burned.
2. Tractor bunched and burned.
3. Concentrations burned.
4. Broadcast burned.
5. Untreated, as check.

Logging and slash disposal created the following nine seedbed-slash density classes:

1. Undisturbed seedbed--light slash.
2. Undisturbed seedbed--medium slash.
3. Undisturbed seedbed--heavy slash.
4. Disturbed mineral soil seedbed--no slash.
5. Disturbed mineral soil seedbed--light slash.
6. Disturbed mineral soil seedbed--medium slash.
7. Burned seedbed--no slash.
8. Burned seedbed--light slash.
9. Burned seedbed--medium slash.

There were no undisturbed seedbeds where slash was absent, nor any heavy slash on either disturbed mineral soil or burned seedbeds. Not all of the nine seedbed-slash density classes were represented on each slash disposal treatment.

Reproduction counts were made in 1959 and 1963. A random sample of 60 milacres was taken on each plot. Numbers and stocking of seedlings, seedbed condition, and slash density were recorded for each milacre sampled. Seedbeds were classified as (1) disturbed mineral soil, (2) undisturbed, or (3) burned on the basis of the condition containing the largest number of seedlings. If no reproduction was present, seedbeds were classified on the basis of the largest percentage of seedbed condition on the milacre. Slash density was rated on the percentage of ground actually covered on each milacre as follows:

1. None--less than 10 percent.
2. Light--10 to 39 percent.
3. Medium--40 to 69 percent.
4. Heavy--70 percent or more.

Results and Conclusions

Lodgepole pine seed in sufficient amounts to restock a clearcut area will not be dispersed more than 200 feet from standing

trees.^{2 3} Since all points on the study area were within 200 feet of uncut timber, seed for restocking came both from (1) cones attached to the slash or knocked from the slash and scattered on the ground, and (2) cones on standing trees.

Slash-borne cones release most of their seeds the first year after cutting. Since nearly all of those seeds will germinate the first year, slash-borne seeds were primarily responsible for restocking on disturbed mineral soil seedbeds and on undisturbed seedbeds with light slash (fig. 2). Most seedlings on burned seedbeds and on undisturbed seedbeds with medium and heavy slash originated after 1959 (fig. 2). Furthermore, about the same number of new seedlings became established each year. Seeds dispersed in more or less consistent quantities each year from trees standing around the perimeter of the study area were primarily responsible for restocking those seedbeds.

Numbers of new seedlings after 5 years differed with both seedbed condition and density of slash. Seedlings were most numerous on disturbed mineral soil seedbeds, and least on burned seedbeds (fig. 2). Numbers of new seedlings on disturbed mineral soil seedbeds decreased as slash density increased, but even where slash was heaviest seedlings were numerous. On undisturbed seedbeds, seedlings were most numerous where slash was light, less numerous where slash was heavier. The generally coarse residual slash on burned seedbeds had no apparent influence on reproduction (fig. 2).

Stocking after 5 years differed with seedbed condition, but density of slash apparently had little influence (fig. 3). Stocking was high

²Dahms, Walter G. *Dispersal of lodgepole pine seed into clear-cut patches*. U. S. Forest Serv. Res. Note PNW-3, 7 pp. 1963. Pacific Northwest Forest and Range Exp. Sta., Portland, Ore.

³Tackle, David. *Regenerating lodgepole pine in central Montana following clear cutting*. U.S. Forest Serv. Res. Note INT-17, 7 pp. 1964. Intermountain Forest and Range Exp. Sta., Ogden, Utah.

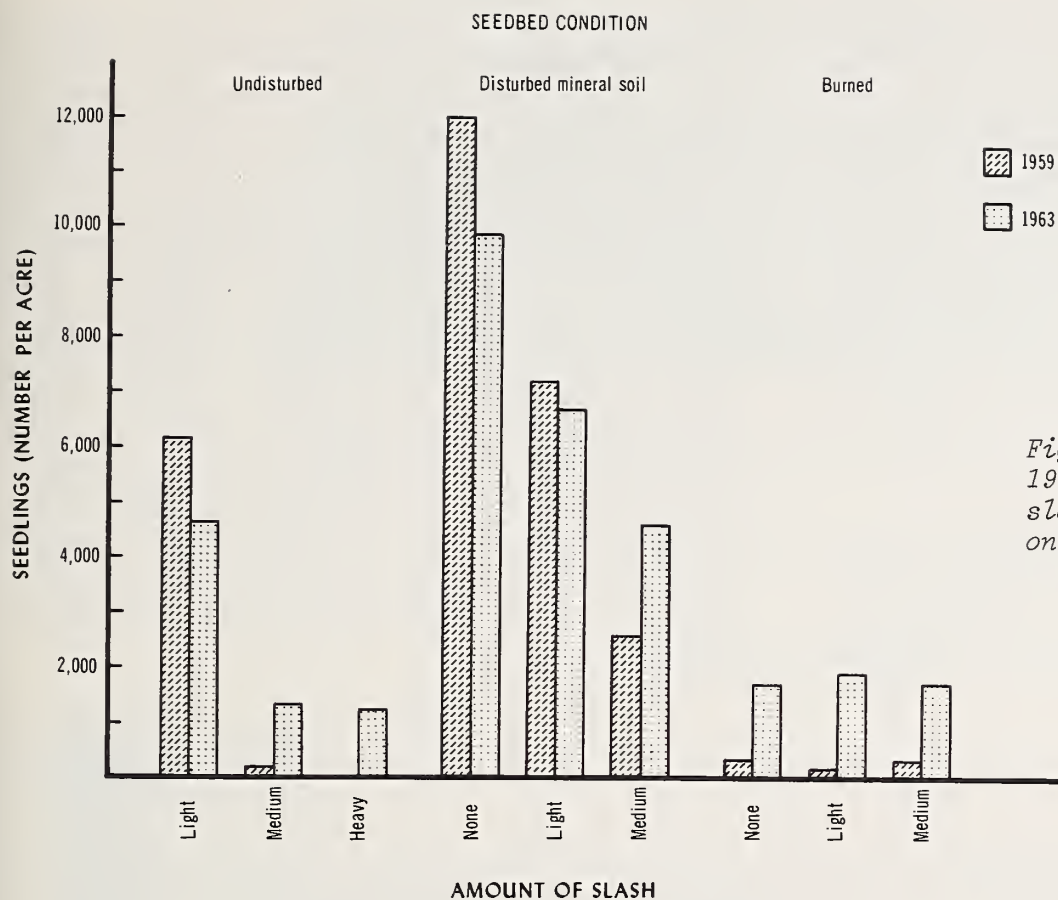


Figure 2.--Number of seedlings in 1959 and 1963 for each seedbed-slash density category (all data on a per-acre basis).

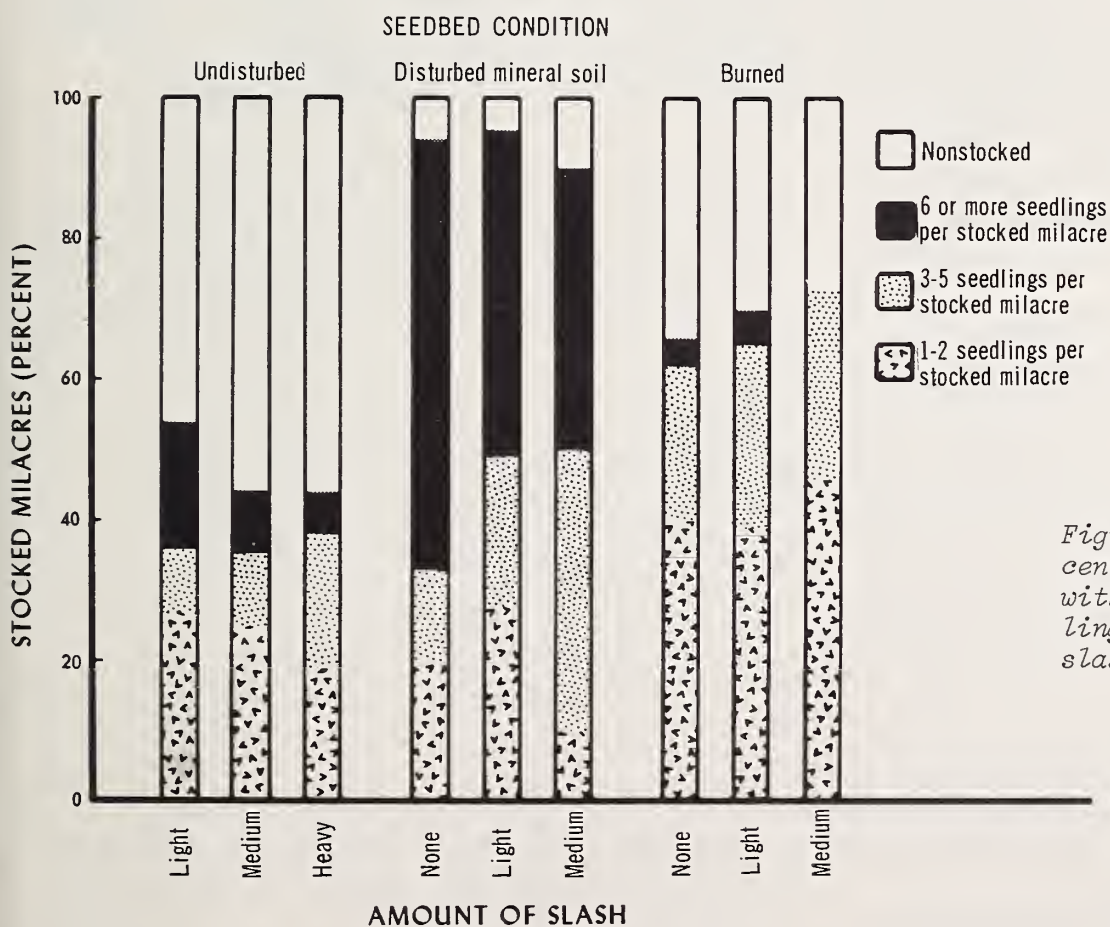


Figure 3.--Stocking and percentage of milacres stocked with different numbers of seedlings in 1963 for each seedbed-slash density category.

on disturbed mineral soil seedbeds, acceptable on burned seedbeds, and too low on undisturbed seedbeds. Because of uniform distribution of seedlings, however, burned seedbeds are considered to have the best stocking. All burned seedbeds had more milacres stocked with one and two seedlings, or one to five seedlings, than any other seedbed condition. Few milacres had more than five seedlings. Although total stocking was highest on disturbed mineral soil seedbeds, from 40 to 60 percent of the milacres sampled had six or more seedlings (fig. 3).

Stocking and number of seedlings in 1963 were related to the proportion of each plot in each seedbed condition (table 1). The concentrations burned plot, where most of the area

was burned, had the most desirable stocking; it had a near-maximum proportion of milacres stocked with near-minimum total seedlings. More than 80 percent of the milacres were stocked with an average of only three seedlings. The broadcast burned plot, with comparable burned area, had the same number of seedlings on each stocked milacre, but fewer milacres were stocked. Stocking was high on the bunched and burned and windrowed and burned plots, but because more of the area had disturbed mineral soil, stocked milacres averaged five to eight seedlings. Lower stocking in relation to number of seedlings on the untreated plot resulted from the failure of seedlings to become established on undisturbed areas with medium and heavy slash (table 1).

Table 1. --Number and stocking of seedlings in 1963, and proportion of area in each seedbed category by slash disposal treatments (all data on a per-acre basis)

Slash disposal treatment	Seedbed condition			Seedlings	Stocking
	Undisturbed	Disturbed mineral soil	Burned		
	- - - Percent - - -			Number	Percent
Windrowed and burned	15	57	28	6,318	83
Bunched and burned	5	35	60	3,767	77
Concentrations burned	0	7	93	2,450	82
Broadcast burned	3	10	87	1,867	60
Untreated	75	25	0	2,650	53